**Homeostasis Culminating Task**

**Endocrinology Internship**

**Overall Curriculum Expectation:**

**🡪** evaluate the impact on the human body of selected chemical substances and of environmental factors related to human activity (E1)

**Specific Curriculum Expectation:**

🡪 assess, on the basis of findings from a case study, the effects on the human body of taking chemical substances to enhance performance or improve health (E1.1)

**Scenario**

You have just begun your tour at a teaching hospital as a medical internship student. Eventually you want to specialize in endocrinology and you have to convince your professors that you have the ability. As a doctor, you will be expected to have the knowledge of human systems and the effect of various drugs on these systems. You will also be expected to understand current research findings, and issues related to each type of drug therapy.

Before you go on first rounds with your supervisor, you need to brush up on endocrine-based disorders and the current issues in endocrinology. What follows are questions that you will be asked and tasks you will be assigned throughout your tour. Prepare to discuss each of them in front of your supervisor and other medical internship students.

**Part A: Research**

1. Investigate what hormones are lacking or in excess for people with the following conditions and how you, as an endocrinologist, might treat these disorders. (Note: Not all of the conditions listed below are necessarily caused solely by malfunctions of the endocrine system.)

* Diabetes Insipidus
* Diabetes Mellitus
* Myxedema
* Graves Disease
* Cushing's Syndrome
* Addison's Disease
* Dwarfism
* Galactorrhoea
* Hirsutism

2. Carefully examine the effects of both estrogen and testosterone on their target cells in detail. Cover at least the following categories.

* Where is each hormone produced?
* How do the hormones get into the cells?
* What is the function of each of the hormones?

3.  What differences are there between steroid hormones, such as estrogen and testosterone, and non-steroid hormones with regard to their mechanism of action on target cells? Provide examples of other hormones belonging to each of the above-mentioned categories.

**Part B: Testing and Inquiry**

Construct two separate graphs of the following average hormone levels found in North American men and women at various ages. Note: Choose the most appropriate type of graph for this data.

|  |  |  |
| --- | --- | --- |
| **Age (years)** | **Average Testosterone  Levels in Males (ng/dL)** | **\*Average Estradiol  (Estrogen)  Levels in Females (pg/mL)** |
| 10 | 200 | 20 |
| 20 | 900 | 100 |
| 30 | 810 | 95 |
| 40 | 650 | 90 |
| 60 | 500 | 30 |
| 70 | 360 | 10 |
| 80 | 220 | 8 |

\*During a female's reproductive years, estradiol levels fluctuate from approximately 25 pg/mL to 200+ pg/mL during the various phases of the menstrual cycle.

1. What is menopause and at what average age does it occur in females?
2. Some people feel there is also a lesser-known condition called andropause that occurs in men. What is andropause?
3. Research both the advantages and disadvantages of receiving hormone replacement therapy.
4. Approximately what percentage of postmenopausal women receives hormone replacement therapy?
5. Interview a family member or someone you know who receives hormone replacement therapy (or recently stopped using it). Report on the reasons for their decision to begin or to stop the treatment. Or visit a medical clinic and speak with a medical professional about why individuals choose to receive hormone replacement therapy and if the advantages do outweigh the disadvantages.

**Part C: Analyze and Reflect**

 Refer to the graphs you constructed. What differences are there in sex hormone levels between men and women as they get older? What specifically causes the declines in sex hormone levels in men and in women?

 Do you think the differences in how the levels of sex hormones decline in men compared to women might have any influence on how society views hormone replacement therapy in men compared to women? Explain.

 A youthful image is perceived to be very important in our society. Some older men have turned to hormone replacement therapy in order to boost their sagging testosterone and human growth hormone levels. What benefits might this have for a man in his late fifties? Are there any dangers associated with testosterone or human growth hormone replacement therapy?

**Part D: Communicate**

Both men and women have dealt with the effects of decreased sex hormone secretions due to the aging process for thousands of years. Only recently has medical science advanced to the point where pharmaceutical companies can produce synthetic forms of these hormones so people can restore (or in some cases enhance) those levels for a variety of physical and psychological reasons.

A local newspaper has asked you to write an editorial outlining facts and your informed opinion about hormone replacement therapy. Do you feel it is necessary and justified for people to take hormone replacements?

**Present thoughtful, organized and in-depth answers to the above questions in roughly 5 page typed report. You must use a minimum of 5 different sources and cite them following the APA style.**

Please review the rubric to ensure you understand how you will be assessed and attach it to the back of your project.

**Endocrinology Internship Rubric**

**Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Criteria** | **Level 1** | **Level 2** | **Level 3** | **Level 4** |
| **Knowledge & Understanding**  - knowledge of facts and terms  /25 | demonstrates limited knowledge and understanding of hormones and their effects on cells  12.5 14 14.5 | demonstrates some knowledge and understanding of hormones and their effects on cells  15 16.5 17 | demonstrates considerable knowledge and understanding of hormones and their effects on cells  17.5 19 19.5 | demonstrates high degree of knowledge and understanding of hormones and their effects on cells  20 23 25 |
| **Inquiry**  - interpretation and analysis of information researched from various sources  /25 | interprets and analyzes graphs of hormone levels with limited accuracy  12.5 14 14.5 | interprets and analyzes graphs of hormone levels with some accuracy  15 16.5 17 | interprets and analyzes graphs of hormone levels with considerable accuracy  17.5 19 19.5 | interprets and analyzes graphs of hormone levels with high degree of accuracy  20 23 25 |
| **Communication**  - communication of information and ideas  /25 | Informed opinion on validity of hormone therapy was written with limited clarity and precision  12.5 14 14.5 | Informed opinion on validity of hormone therapy was written with some clarity and precision  15 16.5 17 | Informed opinion on validity of hormone therapy was written with considerable clarity and precision  17.5 19 19.5 | Informed opinion on validity of hormone therapy was written with a high degree of clarity and precision  20 23 25 |
| **Making Connections**  - assessment of impacts of science and technology on society  /25 | assesses impacts of hormone therapy with limited effectiveness  12.5 14 14.5 | assesses impacts of hormone therapy with moderate effectiveness  15 16.5 17 | assesses impacts of hormone therapy with considerable effectiveness  17.5 19 19.5 | assesses impacts of hormone therapy with high degree of effectiveness  20 23 25 |

Total Mark: /100 = %

**Part A: Research** *Student Hand-Out*

Investigate what hormones are lacking or in excess for people with the following conditions and how you, as an endocrinologist, might treat these disorders. (Note: Not all of the conditions listed below are necessarily caused solely by malfunctions of the endocrine system.

|  |  |
| --- | --- |
| **Condition** | **Hormones Lacking/In Excess/Treatment** |
| Diabetes Insipidus |  |
| Diabetes Mellitus |  |
| Myxedema |  |
| Graves Disease |  |
| Cushing’s Syndrome |  |
| Addison’s Disease |  |
| Dwarfism |  |
| Galactorrhoea |  |
| Hirsutism |  |

2. Carefully examine the effects of both estrogen and testosterone on their target cells in detail.

|  |  |  |  |
| --- | --- | --- | --- |
| **Hormone/Question** | **Produced Where** | **How Hormone Enters Cell** | **Function of Hormone** |
| **Testosterone** |  |  |  |
| **Estrogen** |  |  |  |



3.) What differences are there between steroid hormones, such as estrogen and testosterone, and non-steroid hormones with regard to their mechanism of action on target cells? Provide examples of other hormones belonging to each of the above mentioned categories.

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**Part B: Testing and Inquiry** *Student Hand-out*



Construct two separate graphs of the following average hormone levels found in North American men and women at various ages. Note: Choose the most appropriate type of graph for this data. Graph on a SEPARATE SHEET OF PAPER.

|  |  |  |
| --- | --- | --- |
| **Age (years)** | **Average Testosterone  Levels in Males (ng/dL)** | **\*Average Estradiol  (Estrogen)  Levels in Females (pg/mL)** |
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| 60 | 500 | 30 |
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| 80 | 220 | 8 |

\*During a female's reproductive years, estradiol levels fluctuate from approximately 25 pg/mL to 200+ pg/mL during the various phases of the menstrual cycle.

**On a separate sheet of paper, please answer the following questions:**

1. What is menopause and at what average age does it occur in females?
2. Some people feel there is also a lesser-known condition called andropause that occurs in men. What is andropause?
3. Research both the advantages and disadvantages of receiving hormone replacement therapy.
4. Approximately what percentage of postmenopausal women receives hormone replacement therapy?
5. Interview a family member or someone you know who receives hormone replacement therapy (or recently stopped using it). Report on the reasons for their decision to begin or to stop the treatment. Or visit a medical clinic and speak with a medical professional about why individuals choose to receive hormone replacement therapy and if the advantages do outweigh the disadvantages.

**Part C: Analyze and Reflect** *Student Hand-Out*

Refer to the graphs you constructed. What differences are there in sex hormone levels between men and women as they get older? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



**Please answer the following questions in the space provided:**

What specifically causes the declines in sex hormone levels in men and in women?

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Do you think the differences in how the levels of sex hormones decline in men compared to women might have any influence on how society views hormone replacement therapy in men compared to women? Explain.

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A youthful image is perceived to be very important in our society. Some older men have turned to hormone replacement therapy in order to boost their sagging testosterone and human growth hormone levels. What benefits might this have for a man in his late fifties? Are there any dangers associated with testosterone or human growth hormone replacement therapy?



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**Part D: Communicate** *Student Hand-Out*



Use the space provided to draft your editorial to be published in a health section of a local newspaper. Ensure to include facts about hormone replacement therapy and your opinion supported with research about receiving hormone replacement therapy.

Title of your article: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Your Name and Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Creating your Bibliography Page** *Student Hand-Out*

**Use the following worksheet to conduct research by finding reputable sources that will help you answer all questions. Note the source and outline key points to later help you write your report:**

**APA citation of Source 1:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Point-form notes:**

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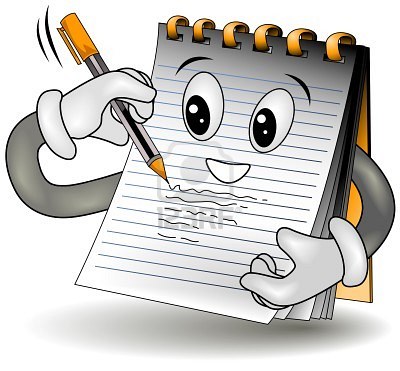
**APA citation of Source 2:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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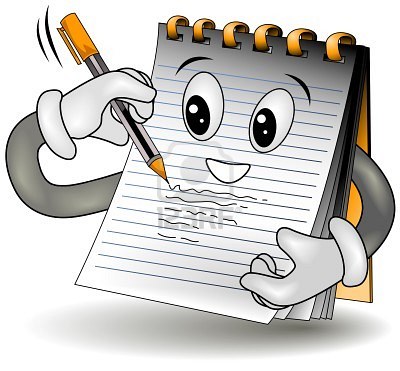
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**APA citation of Source 3: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**APA citation of Source 4: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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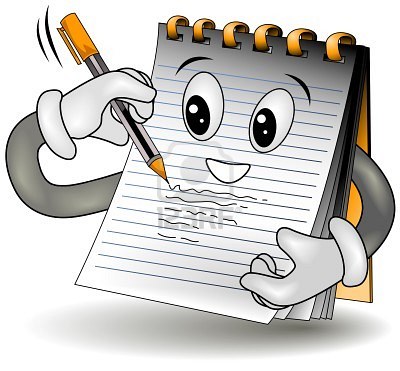
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**APA citation of Source 5: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**APA citation of Source 6: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

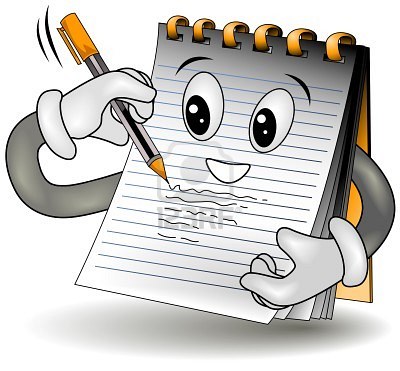
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**Teacher Instructions and Information**

**Teacher Instructions**

Please note that students should have a good understanding of the endocrine system and its relations to homeostasis. They should have had plenty of time to practice both positive and negative feedback loops, and be able to understand the relations between various hormones.

Students will be given handouts that guide them throughout the entire culminating task. You are encouraged to get creative with the task by assuming the role of a professor. Address your students as if they were your medical internship students. You will provide each student with handouts accompanied by a clear task explanation. You can provide students with lab coats if possible to get them to become creative and take on this role as medical internship students.

Divide students into groups of 4 (or more or less depending on the size of the class and the specific group of individuals at hand). Assign roles within groups depending on the learning styles, weaknesses and strengths of each student in the group and allow them to switch roles so each student always has a goal in mind throughout the activities. Ensure to provide students with applicable resources at different stages of the culminating task (these may include handouts, textbooks, websites, newspaper and or magazine articles). Students should also be provided access to computers when needed and this should be organized and managed accordingly. Students will need more than one class to complete the activities and this should be taken into account (and might vary depending on the unique group of students at hand).

Students may have trouble when completing the graph portion of the task. Ensure correct completion of this component of the task by showing and reviewing correct graphing methods in a classroom teacher guided activity. This way, students will feel more confident and be more prepared when completing these graphs on their own.

To allow students to get creative with this task, allow them to act as medical internship students. When students have completed all sections of the culminating task, as an extension you can have them present their findings to the class as medical internship students. They can argue their findings and you can as a professor judge their reflections and conclusions. You can also engage your students in a classroom debate surrounding the hormone replacement therapy.

**Teacher Background Information**

**Diabetes Insipidus**

-caused by a deficiency in ADH secretion from the posterior pituitary

-can be caused by a head injury, inflammation of the hypothalamus, or tumors in the hypothalamus or posterior pituitary

-causes excessive urination and fluid intake as a compensatory response because ADH increases water reabsorption

-results in high plasma sodium levels and increased plasma osmolarity

**Diabetes Mellitus**

-caused by insufficient secretion of insulin from the beta cells of the pancreas

-insufficient insulin in blood, cells cannot use glucose adequately for energy

-primary when it acts directly on the endocrine gland – can be due to tumors of the endocrine gland

**Myxedema**

-thyroid gland does not make enough thyroid hormone, mechanisms fail to maintain homeostasis

**Grave’s disease**

-overactive thyroid, excessive thyroid hormones

-decrease in endocrine symptoms

**Cushing’s Syndrome**

-high levels of cortisol in the blood

-can be caused by taking glucocorticoid drugs, or tumors that produce cortisol or ACTH/CRH

**Addison’s Disease**

-hyposecretion of cortisol characterized by hypoglycemia and poor tolerance of stress

-usually a result of destruction of the adrenal cortex, often a defect in the secretion of aldosterone

Dwarfism

-deficient growth hormone secretion during childhood, irreversible stunt of growth, poor muscle development, higher than normal amounts of body fat

**Galactorrhea**

-spontaneous flow of milk from the breast, elevated levels of TSH or TRH hormones

**Hirsutism**

-excessive hair growth in women, increased level of androgens or oversensitivity of hair follicles to androgens

**Estrogen**

-produced in the ovaries

-necessary for follicular development, promotes development of secondary sex characteristics

(in relation to homeostasis)

-regulate reproductive function

-rise in plasma estrogen concentration can trigger an increase in the secretion of LH

-stimulates estrogen secretion, which enhances LH secretion even more leading to further estrogen secretion

-rapid rise in plasma LH that triggers ovulation (positive feedback)

**Testosterone**

-produced in gonads (testes)

-necessary for sperm production by testis, promotes sex drive and development of secondary sex characteristics

**Menopause**

-changes in hormonal secretory patterns and a host of other physiological changes, loss of reproductive capacity in women

-occurs midlife around late 40’s or early 50’s

**Andropause**

-slow and steady reduction of the production of hormones testosterone and 5-DHEA which then

causes decrease of Leydig cells

**Hormone replacement therapy**

-designed to artificially boost hormone levels- main types being estrogen, progesterone/progestin, and testosterone

-alleviate most physical symptoms of menopause, prevent clinical consequences of an estrogen deficient state

-increased risk of invasive breast cancer and cardiovascular events associated with long-term use

-may be safer alternatives to consider, depend on conditions of the individual

-long term clinical beneficial effects of testosterone poorly defined, magnitude for risks associated with prostate and heart disease remain largely unknown

**Further Resources**

Germann, W. J., & Stanfield, C. L. (2005). *Principles of human physiology*. (2nd ed., pp. 13, 170-204). San Francisco : Pearson Education

**Homeostasis and the Endocrine System**

<http://www.qldscienceteachers.com/junior-science/biology/endocrine-system>

<http://www.nativeremedies.com/articles/endocrine-system-and-homeostasis.html>

<http://www.slideshare.net/sacklax40/endocrine-system-nervous-system-and-homeostatic-control1-presentation>

<http://kidshealth.org/parent/general/body_basics/endocrine.html>

**Endocrine System Diseases**

<http://www.hormone.org/endocrine_system_diseases.cfm>

<http://www.hormone.org/Public/conditions.cfm>

<http://www.nativeremedies.com/articles/diseases-of-the-endocrine-system.html>

**Hormone replacement therapy**

<http://www.womensmentalhealth.org/posts/reevaluating-the-pros-and-cons-of-hormone-replacement-therapy/>

<http://biomedgerontology.oxfordjournals.org/content/59/5/M461.extract>

<http://www.nlm.nih.gov/medlineplus/hormonereplacementtherapy.html>

**Another amazing resource**

<http://mhs.mcsnc.org/UserFiles/Servers/Server_2082346/File/medscience/Medical%20Sciences%20I/P%20Endocrine%20System%20%20M.pdf>